

also may be used for the liquid drop test under the following conditions:

(i) Where the substances to be carried have a specific gravity not exceeding 1.2, the drop heights must be those specified in paragraph (e)(1) of this section for each Large Packaging design type; and

(ii) Where the substances to be carried have a specific gravity exceeding 1.2, the drop heights must be as follows:

(A) Packing Group I:  $SG \times 1.5$  m (4.9 feet).

(B) Packing Group II:  $SG \times 1.0$  m (3.3 feet).

(C) Packing Group III:  $SG \times 0.67$  m (2.2 feet).

(f) *Criteria for passing the test.* For all Large Packaging design types there may be no loss of the filling substance from inner packaging(s) or article(s). Ruptures are not permitted in Large Packaging for articles of Class 1 which permit the spillage of loose explosive substances or articles from the Large Packaging. Where a Large Packaging undergoes a drop test, the sample passes the test if the entire contents are retained even if the closure is no longer sift-proof.

[75 FR 5400, Feb. 2, 2010, as amended at 75 FR 60339, Sept. 30, 2010]

#### § 178.970 Bottom lift test.

(a) *General.* The bottom lift test must be conducted for the qualification of all Large Packagings design types designed to be lifted from the base.

(b) *Special preparation for the bottom lift test.* The Large Packaging must be loaded to 1.25 times its maximum permissible gross mass, the load being evenly distributed.

(c) *Test method.* All Large Packaging design types must be raised and lowered twice by a lift truck with the forks centrally positioned and spaced at three quarters of the dimension of the side of entry (unless the points of entry are fixed). The forks must penetrate to three quarters of the direction of entry.

(d) *Criteria for passing the test.* For all Large Packagings design types designed to be lifted from the base, there may be no permanent deformation which renders the Large Packaging un-

safe for transport and there must be no loss of contents.

#### § 178.975 Top lift test.

(a) *General.* The top lift test must be conducted for the qualification of all of Large Packagings design types to be lifted from the top or, for flexible Large Packagings, from the side.

(b) *Special preparation for the top lift test.* (1) Metal and rigid plastic Large Packagings design types must be loaded to twice its maximum permissible gross mass.

(2) Flexible Large Packaging design types must be filled to six times the maximum permissible gross mass, the load being evenly distributed.

(c) *Test method.* (1) A Large Packaging must be lifted in the manner for which it is designed until clear of the floor and maintained in that position for a period of five minutes.

(2) Rigid plastic Large Packaging design types must be:

(i) Lifted by each pair of diagonally opposite lifting devices, so that the hoisting forces are applied vertically for a period of five minutes; and

(ii) Lifted by each pair of diagonally opposite lifting devices so that the hoisting forces are applied towards the center at 45° to the vertical, for a period of five minutes.

(3) If not tested as indicated in paragraph (c)(1) of this section, a flexible Large Packaging design type must be tested as follows:

(i) Fill the flexible Large Packaging to 95% full with a material representative of the product to be shipped.

(ii) Suspend the flexible Large Packaging by its lifting devices.

(iii) Apply a constant downward force through a specially designed platen. The platen will be a minimum of 60 percent and a maximum of 80 percent of the cross sectional surface area of the flexible Large Packaging.

(iv) The combination of the mass of the filled flexible Large Packaging and the force applied through the platen must be a minimum of six times the maximum net mass of the flexible Large Packaging. The test must be conducted for a period of five minutes.

(v) Other equally effective methods of top lift testing and preparation may

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be used with approval of the Associate Administrator.

(d) *Criterion for passing the test.* For all Large Packagings design types designed to be lifted from the top, there may be no permanent deformation which renders the Large Packagings unsafe for transport and no loss of contents.

### § 178.980 Stacking test.

(a) *General.* The stacking test must be conducted for the qualification of all Large Packagings design types intended to be stacked.

(b) *Special preparation for the stacking test.* (1) All Large Packagings except flexible Large Packaging design types must be loaded to their maximum permissible gross mass.

(2) Flexible Large Packagings must be filled to not less than 95 percent of their capacity and to their maximum net mass, with the load being evenly distributed.

(c) *Test method.* (1) All Large Packagings must be placed on their base on level, hard ground and subjected to a uniformly distributed superimposed test load for a period of at least five minutes (see paragraph (c)(5) of this section).

(2) Fiberboard and wooden Large Packagings must be subjected to the test for 24 hours.

(3) Rigid plastic Large Packagings which bear the stacking load must be subjected to the test for 28 days at 40 °C (104 °F).

(4) For all Large Packagings, the load must be applied by one of the following methods:

(i) One or more Large Packagings of the same type loaded to their maximum permissible gross mass and stacked on the test Large Packaging;

(ii) The calculated superimposed test load weight loaded on either a flat plate or a reproduction of the base of the Large Packaging, which is stacked on the test Large Packaging; or

(5) *Calculation of superimposed test load.* For all Large Packagings, the load to be placed on the Large Packaging must be 1.8 times the combined maximum permissible gross mass of the number of similar Large Packaging that may be stacked on top of the

Large Packaging during transportation.

(d) *Periodic Retest.* (1) The package must be tested in accordance with § 178.980(c) of this subpart; or

(2) The packaging may be tested using a dynamic compression testing machine. The test must be conducted at room temperature on an empty, unsealed packaging. The test sample must be centered on the bottom platen of the testing machine. The top platen must be lowered until it comes in contact with the test sample. Compression must be applied end to end. The speed of the compression tester must be one-half inch plus or minus one-fourth inch per minute. An initial preload of 50 pounds must be applied to ensure a definite contact between the test sample and the platens. The distance between the platens at this time must be recorded as zero deformation. The force “A” to then be applied must be calculated using the applicable formula:

Liquids:  $A = (1.8)(n-1) [w + (s \times v \times 8.3 \times .98)] \times 1.5$ ;

or

Solids:  $A = (1.8)(n-1) [w + (s \times v \times 8.3 \times .95)] \times 1.5$

Where:

A = applied load in pounds.

n = maximum number of Large Packagings that may be stacked during transportation.

w = maximum weight of one empty container in pounds.

s = specific gravity (liquids) or density (solids) of the lading.

v = actual capacity of container (rated capacity + outage) in gallons.

and:

8.3 corresponds to the weight in pounds of 1.0 gallon of water.

1.5 is a compensation factor that converts the static load of the stacking test into a load suitable for dynamic compression testing.

(e) *Criterion for passing the test.* (1) For metal or rigid plastic Large Packagings, there may be no permanent deformation which renders the Large Packaging unsafe for transportation and no loss of contents.

(2) For flexible Large Packagings, there may be no deterioration which renders the Large Packaging unsafe for transportation and no loss of contents.